Appendix C
Parcel B Vapor Migration Model Results

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO MIGRATION FROM GROUNDWATER BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L)	Cancer Risk	Hazard Index
71-43-2	Benzene	0.81	1.37E-10	0.00000022
75-15-0	Carbon disulfide	370	No Slope Factor	0.000052
56-23-5	Carbon tetrachloride	1.5	1.76E-09	0.0000029
71-55-6	Chloroform	5.1	1.2E-10	0.00000021
75-34-3	1,1-Dichloroethaene (1,1-DCA)	0.35	2.84E-12	0.00000010
75-34-3	1,1-Dichloroethylene (1,1-DCE)	0.58	8.4E-10	0.00000067
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	12	No Slope Factor	0.0000035
100-41-4	Ethylbenzene	0.23	No Slope Factor	0.0000000023
98-82-8	Isopropyl-benzene (cumene, 1-methyethyl b	0.32	No Slope Factor	0.0000025
75-09-2	Methylene Chloride	. 6	1.6E-11	0.00000012
78-93-3	Methyl Ethyl Ketone	5.6	No Slope Factor	0.00000000091
79-01-6	Tetrachloroethylene (PCE)	25	2.4E-09	0.000032
108-88-3	Toluene	17	No Slope Factor	0.0000011
79-01 - 6	Trichloroethlyene (TCE)	10,000	2.8E-07	0.00045
95-63 - 6	1,2,4 - Trimethylbenzene	0.43	No Slope Factor	0.0000010
75-01-4	Vinyl chloride	3	8.21E-09	0.000011
1330-20-7	Xylenes	1.4	1.33E-10	0.000011

Total 2.9E-07 0.00056

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Benzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.	<u></u>			
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.80E+04	mg/mole
Vapor pressure	VP	=	1.25E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	8.10E-01	ug/l
Henry's Law Constant	Н	=	2.30E-01	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	1.86E-01	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	2.30E-01	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{f w}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	6.20E+01	cm3/gm
Soil/water distribution coef.	K_d	=	2.48E-01	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.86E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$\theta_{\mathbf{a}}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	8.80E-02 cm2/sec
Effective diffusion coefficient	D_{e}	=	7.06E-03 cm2/sec
Depth of contamination or Csg	Χ	=	1.98E+01 m
Calculated Flux	F.	=	2.39E-05 mg/m2-hour

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second tables$

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Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	٧	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	1.18E-07	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	1.18E-07	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	-
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	iT _c	=	1.37E-09	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	3.85E-09	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	3.85E-09	mg/kg-day
Reference dose	RfD	=	1.71E-02	mg/kg-day
Hazard Index	HI	=	2.25E-07	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	1.37E-09	mg/kg-day
Slope factor (potency)	SF	=	1.00E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	1.37E-10	

 $[\]label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Carbon disulfide

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.60E+04	•
Vapor pressure	VP	=	4.72E-01	
Universal gas constant	R	=		atm-m3/mole-K
Temperature	Т	=	2.93E+02	
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				•
Water contamination level	C _w	=	3.70E+02	ug/l
Henry's Law Constant	Н	=	1.20E+00	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	4.44E+02	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	1.20E+00	dimensionless
Bulk density (dry)	$ ho_{b}$	=	1.50E+00	gm/cc
Air-filled porosity	$\theta_{\mathbf{a}}$	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.60E+01	cm3/gm
Soil/water distribution coef.	K_d	=	1.84E-01	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.44E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionle	SS
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionle	SS
Diffusion coefficient in air	D_a	=	1.00E-01 cm2/sec	
Effective diffusion coefficient	D_{e}	=	8.03E-03 cm2/sec	
Depth of contamination or Csg	Χ	=	1.98E+01 m	
Calculated Flux	F _x	=	6.48E-02 mg/m2-hou	ır

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcutables_second table$

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Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=		exchanges/hr
Ventilation rate	Q	=	1.96E+03	•
Indoor air component	C_{i}	=	3.20E-04	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u 🔧	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.20E-04	mg/m3
EVECULE SCENARIO				
EXPOSURE SCENARIO Body weight	BW	=	7.00E+01	ka
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	_	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversion	1		days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	•
Averaging Time (carc. risk)	AT	=	2.56E+04	* *
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	2 72E-06	mg/kg-day
Chemical Intake (carc. risk)	IT _{nc}	=		mg/kg-day
Chemical intake (non-carc. risk)	''nc	_	1.046-03	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.04E-05	mg/kg-day
Reference dose	RfD	=	2.00E-01	mg/kg-day
Hazard Index	HI	=	5.22E-05	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	3,72E-06	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=		pe Factor
				-

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C-groundwater risk assess calc tables_second table}$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Carbon tetrachloride

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

_	SOURCE - Free Product/Soil>100mg/kg.	OIL			
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	1.50E+05	mg/mole
	Vapor pressure	VP	=	1.51E-01	atm
	Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
	Temperature	T	=	2.93E+02	K
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B.	SOURCE - Groundwater				
	Water contamination level	C_w	= .	1.50E+00	ug/l
	Henry's Law Constant	Н	=	1.20E+00	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	1.80E+00	mg/m3
C.	SOURCE - Soil < 100 mg/kg				
	Soil contamination level	C_t	=		mg/kg
	Henry's Law Constant	Н	=	1.20E+00	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	$\theta_{\textbf{a}}$	=	2.84E-01	dimensionless
	Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K _{oc}	=	1.50E+02	cm3/gm
	Soil/water distribution coef.	K_d	=	6.00E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D.	SOURCE - Measured Soil Gas				
	Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.80E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

То	tal porosity	heta	=	4.34E-01	dimensionless
Air	-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Dif	fusion coefficient in air	D_a	=	7.80E-02	cm2/sec
Eff	fective diffusion coefficient	D_{e}	=	6.26E-03	cm2/sec
De	pth of contamination or Csg	X	=	1.98E+01	m
Ca	lculated Flux	F _x	=	2.05E-04	mg/m2-hour

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C-groundwater risk assess calcutables_second tables$

Version: November 1999

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Risk Calculations

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	C_{i}	=	1.01E-06	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u	=	•	m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	1.01E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	•
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week Weeks per year	conversion			days/week
Exposure frequency	conversion EF	' =	5.00E+01 1.25E+02	•
Averaging Time (carc. risk)	AT	=	2.56E+04	
Averaging Time (carc. risk) Averaging Time (non-carc. risk)	AT	_	9.13E+03	•
Avoraging Time (non-care, risk)	ΛI	_	3.13E+03	uays
Chemical Intake (carc. risk)	IΤ _c	=	1.18E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	iT _{nc}	=		mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	2.89E-06	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	1.18E-08	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	1.76E-09	

 $[\]label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater \ risk \ assess \ calctables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Chloroform

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	SOURCE - Free Product/Soil>100mg/kg.				
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	1.20E+05	mg/mole
	Vapor pressure	VP	=	2.59E-01	atm
	Universal gas constant	R	=		atm-m3/mole-K
	Temperature	T	=	2.93E+02	• -
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
В.	SOURCE - Groundwater				
	Water contamination level	$C_{\mathbf{w}}$.	=	5.10E+00	ug/l
	Henry's Law Constant	Н	=	1.50E-01	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	7.65E-01	mg/m3
C.	SOURCE - Soil < 100 mg/kg				
	Soil contamination level	Ct	=		mg/kg
	Henry's Law Constant	Н	=	1.50E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	$\theta_{\textbf{a}}$	=	2.84E-01	dimensionless
	Water-filled porosity	$\boldsymbol{\theta_w}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm3/gm
	Soil/water distribution coef.	K_d	=	2.12E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
Đ.	SOURCE - Measured Soil Gas				
	Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.65E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$ heta_{a}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	1.00E-01 cm2/sec
Effective diffusion coefficient	D_{e}	=	8.03E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F,	=	1.12E-04 mg/m2-hour

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second table$

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Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	Ε	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	5.51E-07	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=	0.00E+00	m
Wind speed	u	=	0.00E+00	m/hr
Height of building openings	h	=	0.00E+00	m
(or height of breathing zone)	•			
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	5.51E-07	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversi	on	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversi	on	2.50E+00	days/week
Weeks per year	conversi	on	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	6.41E-09	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.80E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.80E-08	mg/kg-day
Reference dose	RfD	=	8.60E-02	mg/kg-day
Hazard Index	HI	=	2.09E-07	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	6.41E-09	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk				·· (····ə···ə)/

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calce tables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	SOURCE - Free Product/Soil>100mg/kg.	<u> </u>			
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	9.90E+04	mg/mole
	Vapor pressure	VP	=	3.08E-01	atm
	Universal gas constant	R	=		atm-m3/mole-K
	Temperature	T	=	2.93E+02	K
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
В	. SOURCE - Groundwater				
	Water contamination level	C_w	=	3.50E-01	ug/l
	Henry's Law Constant	Н	=	2.30E-01	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	8.05E-02	mg/m3
С	. SOURCE - Soil < 100 mg/kg				
	Soil contamination level	C_t	=		mg/kg
	Henry's Law Constant	Н	=	2.30E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
	Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K_{oc}	=	5.30E+01	cm3/gm
	Soil/water distribution coef.	K_d	=	2.12E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D	. SOURCE - Measured Soil Gas	-			
	Measured soil gas concentration	$C_{sq}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 8.05E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$ heta_{ extsf{a}}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	7.40E-02 cm2/sec
Effective diffusion coefficient	D_e	=	5.94E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F _x	=	8.69E-06 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING A. INDOOR AIR COMPONENT

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	٧	=	2.36E+03	m3
Exchange rate of air	Ε	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	4.29E-08	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	4.29E-08	mg/m3
EXPOSURE SCENARIO			•	
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	ļ	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.40E-09	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.40=.00	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	1.40E-01 1.00E-08	mg/kg-uay
Hazara Hiuga	111	_	1.005-00	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	4.99E-10	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	2.84E-12	

 $[\]label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	SOURCE - Free Product/Soil>100mg/kg.				
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	9.70E+04	mg/mole
	Vapor pressure	VP	=	7.78E-01	
	Universal gas constant	R	=		atm-m3/mole-K
	Temperature	T	=	2.93E+02	
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B.	. SOURCE - Groundwater				
	Water contamination level	C_w	=	5.80E-01	ug/l
	Henry's Law Constant	Н	=	1.10E+00	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	6.38E-01	mg/m3
C.	SOURCE - Soil < 100 mg/kg				
	Soil contamination level	C_t	=		mg/kg
	Henry's Law Constant	Н	=	1.10E+00	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
	Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f _{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm3/gm
	Soil/water distribution coef.	K_d	=	2.60E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D.	SOURCE - Measured Soil Gas				
	Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.38E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02 cm2/sec
Effective diffusion coefficient	D_e	=	7.22E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F _v	=	8.38E-05 mg/m2-hour

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Version: November 1999

Risk Calculations

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	Ε	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	4.14E-07	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	4.14E-07	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	-
Inhalation rate	IR 	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET .	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	4 81F-09	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Onemical intake (non-carc. risk)	· · nc		1.002-00	mg/ng-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.35E-08	mg/kg-day
Reference dose	RfD	=	2.00E-02	mg/kg-day
Hazard Index	HI	=	6.74E-07	
OA DONIO GENIO DIOI				
CARCINOGENIC RISK	ıT	_	4.045.00	
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	8.41E-10	

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	Measured soil gas concentration	$C_{sa}(m)$	=		mg/m3 (ug/l)
D.	. SOURCE - Measured Soil Gas	- 39(-7)			
	Calculated soil gas concentration	C _{sg} (s)	=	0.00E+00	-
	Soil/water distribution coef.	K_d	=	1.44E-01	cm3/gm
	Organic carbon partition coefficient	K _{oc}	=	3.60E+01	cm3/gm
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Water-filled porosity	$\theta_{\boldsymbol{w}}$	=	1.50E-01	dimensionless
	Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Henry's Law Constant	Н	=		dimensionless
	Soil contamination level	Ct	=		mg/kg
C.	. SOURCE - Soil < 100 mg/kg				
	Calculated soil gas concentration	$C_{sg}(gw)$	=	2.04E+00	mg/m3
	Henry's Law Constant	Н	=	1.70E-01	dimensionless
	Water contamination level	C_w	=	1.20E+01	ug/l
В	. SOURCE - Groundwater				
	Calculated soil gas concentration	$C_{sg}(fp)$,=	0.00E+00	mg/m3
	Temperature	Т	=	2.93E+02	K
	Universal gas constant	R	=		atm-m3/mole-K
	Vapor pressure	VP	=	2.40E-04	•
	Molecular weight	MW	=	9.70E+04	
, .	Mole fraction	MF	=	0.00E+00	dimensionless
	SOURCE - Free Product/Soil>100mg/kg.	<u> </u>			
G,	ALCULATION OF SOIL GAS CONCENTRATION	ON			

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.04E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless	
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless	
Diffusion coefficient in air	D_a	=	7.40E-02 cm2/sec	
Effective diffusion coefficient	D_{e}	=	5.94E-03 cm2/sec	
Depth of contamination or Csg	Χ	=	1.98E+01 m	
Calculated Flux	F _x	=	2.20E-04 mg/m2-hour	

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second table$

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Version: November 1999

Risk Calculations

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C_{i}	=	1.09E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u ·	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	Co	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	1.09E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	•
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion EF		5.00E+01	•
Exposure frequency	AT	=	1.25E+02 2.56E+04	
Averaging Time (carc. risk) Averaging Time (non-carc. risk)	AT	=	9.13E+03	•
Averaging Time (non-carc. risk)	A1	_	9. ISETUS	uays
Chemical Intake (carc. risk)	iT _c	=	1.26E-08	mg/kg-day
Chemical Intake (non-carc. risk)	(T _{nc}	=	3.55E-08	mg/kg-day
NON CARCINOCENIO PIOU (OL PILL)				
NON-CARCINOGENIC RISK (Chronic Risk)	i T		0.555.00	
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	3.55E-06	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	1.26E-08	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=		pe Factor
				-

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Ethylbenzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	SOURCE - Free Product/Soil>100mg/kg.	<u> </u>			
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	1.10E+05	mg/mole
	Vapor pressure	VP	=	2.43E-02	atm
	Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
	Temperature	T	=	2.93E+02	K
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
В	. SOURCE - Groundwater				
	Water contamination level	C_w	=	2.30E-01	ug/l
	Henry's Law Constant	Н	=	3.20E-01	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	7.36E-02	mg/m3
C	. SOURCE - Soil < 100 mg/kg				
	Soil contamination level	C_t	=		mg/kg
	Henry's Law Constant	Н	=	3.20E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	$\theta_{\textbf{a}}$	=	2.84E-01	dimensionless
	Water-filled porosity	$\theta_{\textbf{w}}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm3/gm
	Soil/water distribution coef.	K_{d}	=	8.00E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D.	SOURCE - Measured Soil Gas	-			
	Measured soil gas concentration	$C_{sa}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.36E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless	
Air-filled porosity	$ heta_{ extsf{a}}$	=	2.84E-01 dimensionless	
Diffusion coefficient in air	D_a	=	7.50E-02 cm2/sec	
Effective diffusion coefficient	D_e	=	6.02E-03 cm2/sec	
Depth of contamination or Csg	X	=	1.98E+01 m	
Calculated Flux	F _x	=	8.05E-06 mg/m2-hour	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables secondtable

Risk Calculations

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Version: November 1999

<u>CALCULATING VAPOR CONCENTRATION IN BUILDING</u>

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	3.98E-08	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h ·	=		m
(or height of breathing zone)				•
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.98E-08	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	ł	8.00E+00	hr/day
Exposure time	ET	=		hr/24 hours
Days per week	conversion	1	2.50E+00	days/week
Weeks per year	conversion	1	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Observation II () ()	· -		4 4-	
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-09	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-09	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	2.27E-09	mg/ng day
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	4.62E-10	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	No Slo	pe Factor

 $[\]label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcy tables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Isopropyl-benzene (cumene, 1-methyethyl benzene)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.	<u>ION</u>			
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.92E-03	atm
Universal gas constant	R	=		atm-m3/mole-K
Temperature	T	=	2.93E+02	
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	3.20E-01	ug/l
Henry's Law Constant	Н	=	4.90E+01	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	1.57E+01	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	4.90E+01	dimensionless
Bulk density (dry)	$ ho_{b}$	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.20E+02	cm3/gm
Soil/water distribution coef.	K_d	=	8.80E-01	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.57E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_{a}	=	7.50E-02 cm2/sec
Effective diffusion coefficient	D_e	=	6.02E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F↓	=	1.72E-03 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	8.47E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L .	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	8.47E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	-
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED .	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET .	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion EF		5.00E+01	•
Exposure frequency Averaging Time (carc. risk)	AT	=		
Averaging Time (carc. risk) Averaging Time (non-carc. risk)	AT	=	9.13E+03	•
Averaging Time (non-carc. risk)	ΛI	_	3.13LT03	uays
Chemical Intake (carc. risk)	IT _c	=	9.85E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	2.76E-07	mg/kg-day
,				
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	2.76E-07	mg/kg-day
Reference dose	RfD	=	1.10E-01	mg/kg-day
Hazard Index	HI	=	2.51E-06	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	9.85E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=		pe Factor

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Methylene Chloride

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	Measured soil gas concentration	$C_{sq}(m)$	=		mg/m3 (ug/l)
D	. SOURCE - Measured Soil Gas	~ ; ,			-
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	-
	Soil/water distribution coef.	K_d	=	4.00E-02	cm3/gm
	Organic carbon partition coefficient	K _{oc}	=	1.00E+01	cm3/gm
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Water-filled porosity	$\theta_{\boldsymbol{w}}$	=	1.50E-01	dimensionless
	Air-filled porosity	θ_a	=	2.84E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Henry's Law Constant	Н	=	9.00E-02	dimensionless
	Soil contamination level	C_{t}	=		mg/kg
С	. SOURCE - Soil < 100 mg/kg	• • •			-
	Calculated soil gas concentration	$C_{sg}(gw)$	=	5.40E-01	
	Henry's Law Constant	H	=		dimensionless
	Water contamination level	C_w	=	6.00E+00	ug/l
В	. SOURCE - Groundwater	- 3g (-1-7			
	Calculated soil gas concentration	C _{sg} (fp)	=	0.00E+00	* *
	Temperature	T	=	2.93E+02	
	Vapor pressure Universal gas constant	VP R	=	5.72E-01	atm atm-m3/mole-K
	Molecular weight	MW	=	8.50E+04	•
	Mole fraction	MF	=		dimensionless
Α	. SOURCE - Free Product/Soil>100mg/kg.				
_	ALGOLITHON OF GOIL ONG GONGLITHAN	911			

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.40E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	$\theta_{\mathbf{a}}$	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	1.00E-01	cm2/sec
Effective diffusion coefficient	D _e	=	8.03E-03	cm2/sec
Depth of contamination or Csg	Χ	=	1.98E+01	m
Calculated Flux	F _x	=	7.88E-05	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

Risk Calculations

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Version: November 1999

CALCULATING	VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=		exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	3.89E-07	mg/m3
B. OUTDOOR AIR COMPONENT	·			J
Downwind contamination length	L	=	0.00E+00	m
Wind speed	u	=	0.00E+00	m/hr
Height of building openings	h	=	0.00E+00	m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	3.89E-07	mg/m3
				_
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion	1	8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion	1	5.00E+01	weeks/yr
Exposure frequency	EF	=	1.25E+02	
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.27E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	1.15E-07	
CARCINOCTNIC RICK				
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	1.58E-11	ž.

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcutables_second tables$

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Methyl Ethyl Ketone

Variable Descriptions

Units

mg/m3 (ug/l)

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.20E+04	mg/mole
Vapor pressure	VP	=	1.20E-01	atm
Universal gas constant	R	==		atm-m3/mole-K
Temperature	Τ	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	5.60E+00	ug/l
Henry's Law Constant	Н	=	1.10E-03	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	6.16E-03	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	1.10E-03	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{m{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.50E+00	cm3/gm
Soil/water distribution coef.	K_d	=	1.80E-02	cm3/gm
Calculated soil gas concentration D. SOURCE - Measured Soil Gas	C _{sg} (s)	=	0.00E+00	mg/m3

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.16E-03 mg/m3

 $C_{sg}(m)$

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Measured soil gas concentration

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$ heta_{ extbf{a}}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02 cm2/sec
Effective diffusion coefficient	D_{e}	=	7.22E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F _x	=	8.09E-07 mg/m2-hour

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C-groundwater risk assess calcitables_second table$

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Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	3.99E-09	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	3.99E-09	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	-
Inhalation rate	IR	=	2.00E+01	<u> </u>
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET .	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF AT	=	1.25E+02	
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	aays
Chemical Intake (carc. risk)	IT _c	=	4 64F-11	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Onemical intake (non-carc. risk)	" nc	_	1.302-10	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.30E-10	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	9.12E-10	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	4.64E-11	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	Risk	=	No Slo	pe Factor

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second table$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Tetrachloroethylene (PCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.			
Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.70E+05 mg/mole
Vapor pressure	VP	=	2.43E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	Τ	=	2.93E+02 K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

 C_w Water contamination level 2.50E+01 ug/l

Henry's Law Constant Н 7.50E-01 dimensionless

 C_{t}

=

Calculated soil gas concentration $C_{sg}(gw)$ 1.88E+01 mg/m3

C. SOURCE - Soil < 100 mg/kg Soil contamination level

mg/kg Henry's Law Constant Н = 7.50E-01 dimensionless Bulk density (dry) 1.50E+00 gm/cc ρ_b Air-filled porosity θ_a 2.84E-01 dimensionless Water-filled porosity $\theta_{\mathbf{w}}$ 1.50E-01 dimensionless Weight fraction of organic carbon 4.00E-03 dimensionless f_{oc} Organic carbon partition coefficient K_{oc} = 2.70E+02 cm3/gmSoil/water distribution coef. K_d 1.08E+00 cm3/gm Calculated soil gas concentration $C_{sq}(s)$ 0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

 $C_{sq}(m)$ Measured soil gas concentration mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.88E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	7.20E-02 cm2/sec
Effective diffusion coefficient	D _e	=	5.78E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F _x	=	1.97E-03 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables secondtable

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	Ε	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	9.72E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	Co	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	9.72E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion)	8.00E+00	
Exposure time	ET	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion	1	5.00E+01	•
Exposure frequency	EF	=	1.25E+02	
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
	· 		4 405 05	
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	3.17E-07	mg/kg-day
NAME OF THE PROPERTY OF THE PARTY OF THE PAR				
NON-CARCINOGENIC RISK (Chronic Risk)	. —		0.475.07	
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	3.17E-05	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	1.13E-07	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	2.37E-09	,

 $\label{lem:condition} \textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C-groundwater risk assess calcy tables_second table}$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Toluene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	Т	=	2.93E+02	• •
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.70E+01	ug/l
Henry's Law Constant	Н	=	2.70E-01	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	4.59E+00	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	2.70E-01	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm3/gm
Soil/water distribution coef.	K_d	=	5.60E-01	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.59E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	8.70E-02	cm2/sec
Effective diffusion coefficient	D_e	=	6.98E-03	cm2/sec
Depth of contamination or Csg	Χ	=	1.98E+01	m
Calculated Flux	F _x	=	5.82E-04	mg/m2-hour

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

Risk Calculations

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	2.88E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	2.88E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	_
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chamical Intelse (care viels)	IT	_	2 245 00	/lan day
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	9.38E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	9.38E-08	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	1.09E-06	
CAPOINO OFNIO PIOI				
Chemical Inteller (agree right)	IT	_	2 245 22	ma m/lem el=: .
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	No Slo	pe Factor

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

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Version: November 1999

Risk Calculations

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Trichloroethlyene (TCE)

Variable Descriptions

Units

mg/m3 (ug/l)

CALCULATION OF SOIL GAS CONCENTRATION

SAESSEATION OF SOIL SAS SONSENTIAL	<u> </u>			
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.00E+04	ug/l
Henry's Law Constant	Н	=	4.20E-01	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	4.20E+03	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	4.20E-01	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	9.40E+01	cm3/gm
Soil/water distribution coef.	K_d	=	3.76E-01	cm3/gm
Calculated soil gas concentration D. SOURCE - Measured Soil Gas	C _{sg} (s)	=	0.00E+00	mg/m3

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.20E+03 mg/m3

 $C_{sg}(m)$

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Measured soil gas concentration

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$ heta_{ extbf{a}}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	7.90E-02 cm2/sec
Effective diffusion coefficient	D_{e}	=	6.34E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.84E-01 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

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Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C_{i}	=	2.39E-03	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	2.39E-03	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	iR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
				
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	7.79E-05	mg/kg-day
NON CAROINOCENIO PIOIZ (Observito Piala)				
NON-CARCINOGENIC RISK (Chronic Risk)			7 705 05	"
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	4.55E-04	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	2.78E-05	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	2.78E-07	, , , ,

 $[\]textbf{G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C-groundwater risk assess calcy tables_second table} \\$

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

1,2,4 - Trimethylbenzene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00 dimensionless	
Molecular weight	MW	=	1.20E+05 mg/mole	
Vapor pressure	VP	=	2.76E-03 atm	
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K	
Temperature	Т	=	2.93E+02 K	

Calculated soil gas concentration $C_{sg}(fp) = 0.00E+00 \text{ mg/m}3$

B. SOURCE - Groundwater

Water contamination level $C_w = 4.30E-01 \text{ ug/l}$

Henry's Law Constant H = 2.30E-01 dimensionless

Calculated soil gas concentration $C_{sg}(gw) = 9.89E-02 \text{ mg/m}3$

C. SOURCE - Soil < 100 mg/kg

 C_t = mg/kg Soil contamination level Н = 2.30E-01 dimensionless Henry's Law Constant Bulk density (dry) 1.50E+00 gm/cc ρ_{b} 2.84E-01 dimensionless Air-filled porosity θ_a Water-filled porosity θ_{w} 1.50E-01 dimensionless Weight fraction of organic carbon f_{oc} 4.00E-03 dimensionless Organic carbon partition coefficient K_{oc} 3.70E+03 cm3/gm Kd = 1.48E+01 cm3/gm Soil/water distribution coef. $C_{sg}(s)$ 0.00E+00 mg/m3 Calculated soil gas concentration =

D. SOURCE - Measured Soil Gas

Measured soil gas concentration $C_{sg}(m) = mg/m3 (ug/l)$

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 9.89E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	7.50E-02 cm2/sec
Effective diffusion coefficient	D_{e}	=	6.02E-03 cm2/sec
Depth of contamination or Csg	Χ	=	1.98E+01 m
Calculated Flux	F_{x}	=	1.08E-05 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING	G
A. INDOOR AIR COMPONENT	_

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	5.34E-08	mg/m3
B. OUTDOOR AIR COMPONENT				-
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C。	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	5.34E-08	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=		• •
Averaging Time (carc. risk)	AT	=		•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chamical Intelle (care viola)	17			
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.74E-09	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.74E-09	mg/kg-day
Reference dose	RfD	=	1.70E-03	mg/kg-day
Hazard Index	HI	=	1.02E-06	0 0 ,
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	6.21E-10	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=		pe Factor

 $[\]label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcy tables_second table$

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Vinyl chloride

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	6.30E+04	mg/mole
Vapor pressure	VP	=	3.50E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_{w}	=	3.00E+00	ug/l
Henry's Law Constant	Н	=	1.10E+00	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	3.30E+00	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	1.10E+00	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.90E+01	cm3/gm
Soil/water distribution coef.	K_d	=	7.60E-02	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.30E+00 mg/m3

<u>DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE</u>

Calculated Flux	F_{x}	=	5.29E-04 mg/m2-hour
Depth of contamination or Csg	X	=	1.98E+01 m
Effective diffusion coefficient	D_e	=	8.83E-03 cm2/sec
Diffusion coefficient in air	D_a	=	1.10E-01 cm2/sec
Air-filled porosity	θ_{a}	=	2.84E-01 dimensionless
Total porosity	θ	=	4.34E-01 dimensionless

 $\label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcitables_second table$

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

Risk Calculations

CALCULATING VAPOR CONCENTRATION IN	N BUILDING			
A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	Sb	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	Е	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	2.61E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m .
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	2.61E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	ka
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversion		8.00E+00	•
Exposure time	ET	` =		hr/24 hours
Days per week	conversion	1		days/week
Weeks per year	conversion		5.00E+01	•
Exposure frequency	EF	=	1.25E+02	•
Averaging Time (carc. risk)	AT	=		• •
Averaging Time (non-carc. risk)	AT	=	9.13E+03	•
Chamical Intaka (aara riak)	IT _c	_	2.045.00	malka day
Chemical Intake (carc. risk)	=	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	8.53E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	8.53E-08	mg/kg-day
Reference dose	RfD	=	7.43E-03	mg/kg-day
Hazard Index	HI	=	1.15E-05	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	3.04E-08	mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	8.21E-09	(inging day)

 $[\]label{lem:G:projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calcy tables_second table$

Risk Calculations

Version: November 1999

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Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Xylenes

Variable Descriptions

Units

0.00E+00 mg/m3

mg/m3 (ug/l)

CALCULATION OF SOIL GAS CONCENTRATION

GALEGEATION OF GOIL GAS CONCENTRAT	IOIA			
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.40E+00	ug/l
Henry's Law Constant	Н	=	7.50E-01	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	1.05E+00	mg/m3
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	Н	=	7.50E-01	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K_d	=	1.08E+00	cm3/gm

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.05E+00 mg/m3

 $C_{sg}(s)$

 $C_{sg}(m)$

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Calculated soil gas concentration

D. SOURCE - Measured Soil Gas Measured soil gas concentration

_					
	Total porosity	θ	=	4.34E-01	dimensionless
	Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
	Diffusion coefficient in air	D_a	=	7.20E-02	cm2/sec
	Effective diffusion coefficient	D_{e}	=	5.78E-03	cm2/sec
	Depth of contamination or Csg	Χ	=	1.98E+01	m
	Calculated Flux	F _x	=	1.10E-04	ma/m2-hour

 $\label{lem:condition} G: projects/environmental/boeing/C6/ParcelB/Final/Appendix\ C-groundwater\ risk\ assess\ calc\ tables_second table$

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL Risk Calculations

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	٧	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	5.45E-07	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u	= ,		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C°	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	5.45E-07	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion)	8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversion			days/week
Weeks per year	conversion)	5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	ΙΤ	_	6 225 00	manifer day.
•	IT _c	=		mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	1./8E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.78E-08	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	1.78E-06	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	6.33E-09	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	Risk	=	1.33E-10	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

CHEMICAL PARAMETERS

		MW	H' (dimension-	Da	VP	Temp.		K _{oc}	Water Solubility		CSF (inh)		Chronic RfD (inh)	
		(mg/mole)	less)	(cm²/sec)	(atm)	(°C)		(cm³/g)	(mg/L-water))	(mg/kg-day) ⁻¹		(mg/kg-day)	
CAS No.														
71-43-2	Benzene	7.8E+04 a	2.3E-01 a	8.8E-02 a	1.2E-01	25	ь.	6.2E+01	1.8E+03	а	1.00E-01		1.71E-02	
75-15-0	Carbon disulfide	7.6E+04 a	1.2E+00 a	1.0E-01 a	4.7E-01		ь	4.6E+01		a	0.00E+00		2.00E-01	
56-23-5	Carbon tetrachloride	1.5E+05 a	1.2E+00 a	7.8E-02 a	1.5E-01		h	1.5E+02		a	1.50E-01		1.14E-02	I
67-66-3	Chloroform	1.2E+05 a	1.5E-01 a	1.0E-01 a	2.6E-01		ь	5.3E+01		a	1.9E-02	С	8.6E-02	
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04 a	2.3E-01 a	7.4E-02 a	3.1E-01		h	5.3E+01	1 111 111	a	5.70E-03	C	1.40E-01	e
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04 a	1.1E+00 a	9.0E-02 a	7.8E-01		h	6.5E+01		a	1.75E-01		2.00E-02	1
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04 a	1.7E-01 a	7.4E-02 a	2.4E-04		b	3.6E+01		a	0.00E+00		1.00E-02	Ī
100-41-4	Ethylbenzene	1.1E+05 a	3.2E-01 a	7.5E-02 a	1.3E-02		b .	2.0E+02		a	0.00E+00		5.71E-01	ļ
98-82-8	Isopropyl-benzene (cumene, 1- methyethyl benzene)	1.2E+05 a	4.9E+01 a	7.5E-02 a	5.9E-03		b	2.2E+02		а	0.00E+00		1.10E-01	
75-09-2	Methylene Chloride	8.5E+04 a	9.0E-02 a	1.0E-01 a	5.7E-01	25	ь	1.0E+01	1.3E+04	а	3.5E-03	С	1.1E-01	e
78-93-3	Methyl Ethyl Ketone	7.2E+04 a	1.1E-03 a	9.0E-02 a	1.2E-01	25	b	4.5E+00	1 2722 23	a	0.00E+00	•	1,43E-01	Ĭ
127-18-4	Tetrachloroethylene (PCE)	1.7E+05 a	7.5E-01 a	7.2E-02 a	2.4E-02	25	b	2.7E+02	2.0E+02	а	2.1E-02	С	1.0E-02	e
108-88-3	Toluene	9.2E+04 a	2.7E-01 a	8.7E-02 a	3.7E-02	25	ь	1.4E+02 a	5.3E+02	a	0.00E+00		8.57E-02	
79-01-6	Trichloroethlyene (TCE)	1.3E+05 a	4.2E-01 a	7.9E-02 a	7.6E-02	20	b	9.4E+01 a	1.1E+03	а	1.00E-02		1.71E-01	
95-63-6	1,2,4 - Trimethylbenzene	1.2E+05 a	2.3E-01 a	7.5E-02 a	2.8E-03	25	Ь	3.7E+03 a	2.6E-01	а	0.00E+00		1.70E-03	ŀ
75-01-4	Vinyl chloride	6.3E+04 a	1.1E+00 a	1.1E-01 a	3.5E+00	25	b	1.9E+01 a	2.8E+03	а	2.70E-01		7.43E-03	1
1330-20-7	Xylenes	1.1E+05 a	3.0E-01 a	7.0E-02 a	1.1E-02	25	þ	2.0E+02 a	1.6E+02	а	0.00E+00		2.00E-01	J

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, http://www.arb.ca.gov/ab2588/riskassess.htm

Toxicity Value reference priority:

- 1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
- 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, http://www.arb.ca.gov/ab2588/riskassess.htm
- 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO MIGRATION FROM GROUNDWATER AFTER CHEMICAL LEACHING TO GROUNDWATER BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L greater that 12 feet)	Cancer Risk	Hazard Index	
75-35-4	1,1-Dichloroethylene (1,1-DCE)	2.6	3.8E-09	0.0000030	
127-18-4	Tetrachloroethylene (PCE)	0.29	2.8E-11	0.0000037	
108-88-3	Toluene	0.27	No Slope Factor	0.00000017	
79-01 - 6	Trichloroethlyene (TCE)	15	4.2E-10	0.00000068	

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

STREET STREET	1011			
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.60E+00	ug/l
Henry's Law Constant	Н	=	1.10E+00	dimensionless
Calculated soil gas concentration	$C_{sg}(gw)$	=	2.86E+00	mg/m3
C. SOURCE - Soil < 100 mg/kg				t.
Soil contamination level	C_{t}	=		mg/kg
Henry's Law Constant	Н	=	1.10E+00	dimensionless
Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Water-filled porosity	$\theta_{\mathbf{w}}$	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm3/gm
Soil/water distribution coef.	K_d	=	2.60E-01	cm3/gm
Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.86E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$\theta_{\mathbf{a}}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02 cm2/sec
Effective diffusion coefficient	D_e	=	7.22E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F _x	=	3.75E-04 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

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Version: November 1999

Risk Calculations

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	C_{i}	=	1.85E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	1.85E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversior	1	8.00E+00	•
Exposure time	ET	=		hr/24 hours
Days per week	conversior			days/week
Weeks per year	conversion	1	5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	IT _c	=	2.16E-08	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	6.05E-08	mg/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	6.05E-08	mg/kg-day
Reference dose	RfD	=	2.00E-02	mg/kg-day
Hazard Index	HI	=	3.02E-06	
CARCINOGENIC RISK				
Chemical Intake (carc. risk)	IT _c	=	2.16E-08	mg/kg-day
Slope factor (potency)	SF	=	1.75E-01	1/(mg/kg-day)
Cancer Risk	Risk	=	3.77E-09	

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

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Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Tetrachloroethylene (PCE)

Variable Descriptions

Units

mg/kg

CALCULATION OF SOIL GAS CONCENTRATION

Α.	S	O	UR	CE -	Free	Produc	t/Soil>	100mg/k	g.
			_						

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.70E+05 mg/mole
Vapor pressure	VP	=	2.43E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	Т	=	2.93E+02 K
Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00 mg/m3
B. SOURCE - Groundwater			
Water contamination level	C_{w}	=	2.90E-01 ug/l

Henry's Law Constant H = 7.50E-01 dimensionless Calculated soil gas concentration $C_{sg}(gw) = 2.18E-01$ mg/m3

C. SOURCE - Soil < 100 mg/kg

Henry's Law Constant Н 7.50E-01 dimensionless = Bulk density (dry) 1.50E+00 gm/cc ρ_b Air-filled porosity θ_a 2.84E-01 dimensionless Water-filled porosity θ_{w} 1.50E-01 dimensionless Weight fraction of organic carbon f_{oc} 4.00E-03 dimensionless Organic carbon partition coefficient K_{oc} = 2.70E+02 cm3/gmSoil/water distribution coef. K_d 1.08E+00 cm3/gm Calculated soil gas concentration $C_{sg}(s)$ 0.00E+00 mg/m3 =

 C_t

D. SOURCE - Measured Soil Gas

Soil contamination level

Measured soil gas concentration $C_{sg}(m) = mg/m3 (ug/l)$

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.18E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	$\theta_{\mathbf{a}}$	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	D_{e}	=	5.78E-03	cm2/sec
Depth of contamination or Csg	Χ	=	1.98E+01	m
Calculated Flux	F_x	=	2.28E-05	mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

Risk Calculations Version: November 1999

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CALCULATING VAPOR CONCENTRATION IN BUILDING
A. INDOOR AIR COMPONENT

A	A. INDOOR AIR COMPONENT				
	Floor area of building	Α	=	9.68E+02	m2
	% of floor area that flux occurs			1.00E+00	dimensionless
	Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
	Flux area within building	Af	=	9.68E+00	m2
	Interior Height of building	R_h	=	2.44E+00	m
	Volume of building	V	=	2.36E+03	m3
	Exchange rate of air	E	=	8.30E-01	exchanges/hr
	Ventilation rate	Q	=	1.96E+03	_
	Indoor air component	C_{i}	=	1.13E-07	mg/m3
E	B. OUTDOOR AIR COMPONENT				_
	Downwind contamination length	L	=		m
	Wind speed	u	=		m/hr
	Height of building openings	h	=		m
	(or height of breathing zone)				
	Outdoor air component	C _o	=	0.00E+00	mg/m3
C	. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.13E-07	mg/m3
F	EXPOSURE SCENARIO				
-	Body weight	BW	=	7.00E+01	ka
	Inhalation rate	IR	=	2.00E+01	_
	Exposure duration	ED	=	2.50E+01	•
	Hours per day	conversion		8.00E+00	•
	Exposure time	ET	_		hr/24 hours
	Days per week	conversion	ı		days/week
	Weeks per year	conversion		5.00E+01	•
	Exposure frequency	EF	=	1.25E+02	₹
	Averaging Time (carc. risk)	AT	=	2.56E+04	• •
	Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
	Chemical Intake (carc. risk)	IT _c	=	1.31F-09	mg/kg-day
	Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
	Constitution (Constitution)	IIC		3.002 00	g/g wwy
N	ON-CARCINOGENIC RISK (Chronic Risk)				•
	Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
	Reference dose	RfD	=		mg/kg-day
	Hazard Index	HI	=	3.68E-07	
<u>C</u>	ARCINOGENIC RISK				
	Chemical Intake (carc. risk)	IT _c	=	1.31E-09	mg/kg-day
	Slope factor (potency)	SF	=		1/(mg/kg-day)
	Cancer Risk	Risk	=	2.75E-11	(0 0)/

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

Risk Calculations

Version: November 1999

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Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Toluene

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

	. SOURCE - Free Product/Soil>100mg/kg.				
	Mole fraction	MF	=	0.00E+00	dimensionless
	Molecular weight	MW	=	9.20E+04	mg/mole
	Vapor pressure	VP	=	3.74E-02	atm
	Universal gas constant	R	=		atm-m3/mole-K
	Temperature	T	=	2.93E+02	K
	Calculated soil gas concentration	$C_{sg}(fp)$	=	0.00E+00	mg/m3
В	. SOURCE - Groundwater				
	Water contamination level	C_w	=	2.70E-01	ug/l
	Henry's Law Constant	Н	=	2.70E-01	dimensionless
	Calculated soil gas concentration	$C_{sg}(gw)$	=	7.29E-02	mg/m3
C.	. SOURCE - Soil < 100 mg/kg				
	Soil contamination level	C_t	=		mg/kg
	Henry's Law Constant	Н	=	2.70E-01	dimensionless
	Bulk density (dry)	ρ_{b}	=	1.50E+00	gm/cc
	Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
	Water-filled porosity	$\boldsymbol{\theta_w}$	=	1.50E-01	dimensionless
	Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
	Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm3/gm
	Soil/water distribution coef.	K_d	=	5.60E-01	cm3/gm
	Calculated soil gas concentration	$C_{sg}(s)$	=	0.00E+00	mg/m3
D.	SOURCE - Measured Soil Gas				
	Measured soil gas concentration	$C_{sg}(m)$	=		mg/m3 (ug/l)

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.29E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01 dimensionless
Air-filled porosity	$ heta_{a}$	=	2.84E-01 dimensionless
Diffusion coefficient in air	D_a	=	8.70E-02 cm2/sec
Effective diffusion coefficient	D_e	=	6.98E-03 cm2/sec
Depth of contamination or Csg	X	=	1.98E+01 m
Calculated Flux	F.	=	9.25E-06 mg/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL Risk Calculations

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	_
Indoor air component	Ci	=	4.57E-08	mg/m3
B. OUTDOOR AIR COMPONENT				_
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	C_{t}	=	4.57E-08	mg/m3
EXPOSURE SCENARIO				
Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	•
Exposure duration	ED	=	2.50E+01	•
Hours per day	conversior	1	8.00E+00	•
Exposure time	ET	=	3.33E-01	hr/24 hours
Days per week	conversior			days/week
Weeks per year	conversior	1	5.00E+01	•
Exposure frequency	EF	=	1.25E+02	• •
Averaging Time (carc. risk)	AT	=	2.56E+04	•
Averaging Time (non-carc. risk)	AT	=	9.13E+03	days
Chemical Intake (carc. risk)	íT _c	=	5 31F-10	mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=		mg/kg-day
Onemodi intake (non-care. nek)	''nc	_	1.436-03	nig/kg-day
NON-CARCINOGENIC RISK (Chronic Risk)				
Chemical Intake (non-carc. risk)	IT _{nc}	=	1.49E-09	mg/kg-day
Reference dose	RfD	=		mg/kg-day
Hazard Index	HI	=	1.74E-08	5.70 · · · · · ·
CARCINOCENIC DICK				
Chamical Intella (againstall)	(T		E 0.45 40	,
Chemical Intake (carc. risk)	IT _c	=		mg/kg-day
Slope factor (potency)	SF	=		1/(mg/kg-day)
Cancer Risk	Risk	=	No Slo	pe Factor

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

Risk Calculations

Version: November 1999

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Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical:

Trichloroethlyene (TCE)

Variable Descriptions

Units

CALCULATION OF SOIL GAS CONCENTRATION

Δ	SOURCE	- Free	Product/Soil>100mg/kg.
Л.	COULCE	- 1 1 56	riouuct/Son/iooma/ku.

Mole fraction	MF	=	0.00E+00	dimensionless	
Molecular weight	MW	=	1.30E+05	mg/mole	
Vapor pressure	VP	=	7.61E-02	atm	
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K	
Tanana and I	_				

Temperature T = 2.93E+02 K

Calculated soil gas concentration $C_{sg}(fp) = 0.00E+00 \text{ mg/m}3$

B. SOURCE - Groundwater

Water contamination level $C_w = 1.50E+01 \text{ ug/l}$

Henry's Law Constant H = 4.20E-01 dimensionless

Calculated soil gas concentration $C_{sq}(gw) = 6.30E+00 \text{ mg/m}3$

C. SOURCE - Soil < 100 mg/kg

Soil contamination level C_t mg/kg Henry's Law Constant Н = 4.20E-01 dimensionless 1.50E+00 gm/cc Bulk density (dry) ρ_{b} Air-filled porosity θ_a 2.84E-01 dimensionless Water-filled porosity θ_{w} 1.50E-01 dimensionless Weight fraction of organic carbon f_{oc} 4.00E-03 dimensionless Organic carbon partition coefficient Koc = 9.40E+01 cm3/gmSoil/water distribution coef. K_{d} 3.76E-01 cm3/gm

Calculated soil gas concentration $C_{sg}(s) = 0.00E+00 \text{ mg/m}^3$

D. SOURCE - Measured Soil Gas

Measured soil gas concentration $C_{sg}(m) = mg/m3 (ug/l)$

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.30E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_{a}	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.90E-02	cm2/sec
Effective diffusion coefficient	D_{e}	=	6.34E-03	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	F.,	=	7 26F-04	ma/m2-hour

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

CALCULATING VAPOR CONCENTRATION IN BUILDING

Risk Calculations

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Version: November 1999

A. INDOOR AIR COMPONENT				
Floor area of building	Α	=	9.68E+02	m2
% of floor area that flux occurs	•		1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	9.68E+00	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	2.36E+03	m3
Exchange rate of air	Ε	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	1.96E+03	m3/hr
Indoor air component	Ci	=	3.58E-06	mg/m3
B. OUTDOOR AIR COMPONENT				
Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings	h	=		m
(or height of breathing zone)				
Outdoor air component	C _o	=	0.00E+00	mg/m3
C. TOTAL INDOOR AIR CONCENTRATION	Ct	=	3.58E-06	mg/m3
EXPOSURE SCENARIO				
Body weight	DIA	_		_
	BW	=	7.00E+01	kg
Inhalation rate	IR	=	7.00E+01 2.00E+01	•
• •				m3/day
Inhalation rate	IR	=	2.00E+01	m3/day yrs
Inhalation rate Exposure duration	IR ED	=	2.00E+01 2.50E+01 8.00E+00	m3/day yrs
Inhalation rate Exposure duration Hours per day	IR ED conversion	= = 1 =	2.00E+01 2.50E+01 8.00E+00 3.33E-01	m3/day yrs hr/day
Inhalation rate Exposure duration Hours per day Exposure time	IR ED conversion ET	= 1	2.00E+01 2.50E+01 8.00E+00 3.33E-01	m3/day yrs hr/day hr/24 hours days/week
Inhalation rate Exposure duration Hours per day Exposure time Days per week	IR ED conversion ET conversion	= 1	2.00E+01 2.50E+01 8.00E+00 3.33E-01 2.50E+00 5.00E+01 1.25E+02	m3/day yrs hr/day hr/24 hours days/week weeks/yr days/yr
Inhalation rate Exposure duration Hours per day Exposure time Days per week Weeks per year	IR ED conversion ET conversion conversion	= 1 = 1	2.00E+01 2.50E+01 8.00E+00 3.33E-01 2.50E+00 5.00E+01	m3/day yrs hr/day hr/24 hours days/week weeks/yr days/yr
Inhalation rate Exposure duration Hours per day Exposure time Days per week Weeks per year Exposure frequency	IR ED conversion ET conversion conversion EF	= 	2.00E+01 2.50E+01 8.00E+00 3.33E-01 2.50E+00 5.00E+01 1.25E+02	m3/day yrs hr/day hr/24 hours days/week weeks/yr days/yr days
Inhalation rate Exposure duration Hours per day Exposure time Days per week Weeks per year Exposure frequency Averaging Time (carc. risk)	IR ED conversion ET conversion conversion EF AT	= = = =	2.00E+01 2.50E+01 8.00E+00 3.33E-01 2.50E+00 5.00E+01 1.25E+02 2.56E+04 9.13E+03	m3/day yrs hr/day hr/24 hours days/week weeks/yr days/yr days

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.17E-07 mg/kg-day
Reference dose	RfD	=	1.71E-01 mg/kg-day

Hazard Index HI = 6.82E-07

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.17E-08 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Dick	Diek	_	4 47E 40

Cancer Risk = 4.17E-10

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - Leachate vapor risk

CHEMICAL PARAMETERS

	MW (mg/mole)	H' (dimension- less)	Da (cm²/sec)	VP (atm)	Temp.	K _{oc}	Water Solubility (mg/L-water)	CSF (inh)	Chronic RfD (inh) (mg/kg-day)
CAS No.									
127-18-4 Tetrachloroethylene (PCE)	1.7E+05 a	7.5E-01 a	7.2E-02 a	2.4E-02	25 b	2.7E+02 a	2.0E+02 a	2.1E-02	1.0E-02
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04 a	1.1E+00 a	9.0E-02 a	7.8E-01	25 b	6.5E+01 a	2.3E+03 a	1.75E-01	2.00E-02
108-88-3 Toluene	9.2E+04 a	2.7E-01 a	8.7E-02 a	3.7E-02	25 b	1.4E+02 a	5.3E+02 a	0.00E+00	8.57E-02
79-01-6 Trichloroethlyene (TCE)	1.3E+05 a	4.2E-01 a	7.9E-02 a	7.6E-02	20 b	9.4E+01 a	1.1E+03 a	1.00E-02	1.71E-01

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, http://nsk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, http://www.arb.ca.gov/ab2588/riskassess.htm

Toxicity Value reference priority:

- 1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
- 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, http://www.arb.ca.gov/ab2588/riskassess.htm
- 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.